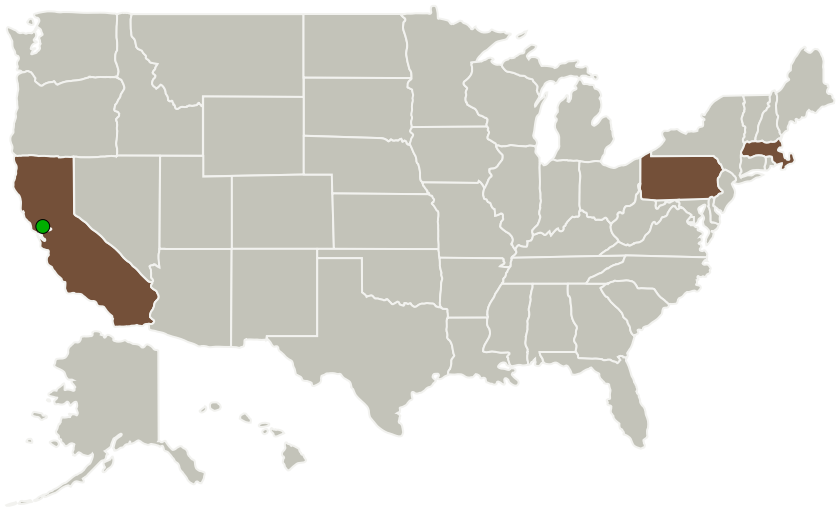
Advanced Algorithms and Controls for Superior Robotic All-Terrain Mobility, Phase I

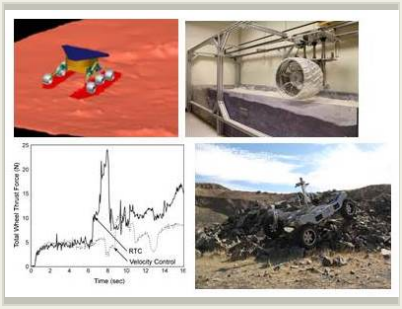
Completed Technology Project (2014 - 2014)

Project Introduction

ProtoInnovations, LLC (PI) and the Massachusetts Institute of Technology (MIT) have formed a partnership to research, develop, and experimentally test a suite of methods for significantly improving the safety, mean travel speed, and rough-terrain access of wheeled planetary exploration rovers. We will accomplish this by developing algorithms for all-terrain adaptive locomotion. This will include algorithms for: 1. Traction control, which will intelligently govern individual wheel commands as a function of terrain conditions in order to measurably decrease wheel slip; and, 2. Embedding detection, which monitors the rover's inertial signature to rapidly and robustly detect instances of incipient embedding in soft, low bearing-strength regolith. Our aim is to provide a novel approach for enhancing rover traction and reducing slip that will not only allow rovers to autonomously detect and avoid hazardous terrain regions, but also to travel with assured safety on terrain that is steeper and rougher than is currently possible. The result of this work will be systems that can rove with a reduced risk of catastrophic failure, while simultaneously increasing both the quantity and potential quality of science data products. This latter capability is enabled by the fact that rovers will be able to travel for long durations without requiring lengthy human interventions, and will be able to travel to sites of greater scientific interest (and proportionally greater mobility difficulty) than what is possible today.

Primary U.S. Work Locations and Key Partners





Advanced Algorithms and Controls for Superior Robotic All-Terrain Mobility Project Image

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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Protoinnovations, LLC	Lead Organization	Industry	Pittsburgh, Pennsylvania
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Massachusetts Institute of Technology(MIT)	Supporting Organization	Academia	Cambridge, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts
Pennsylvania	

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140622)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Protoinnovations, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

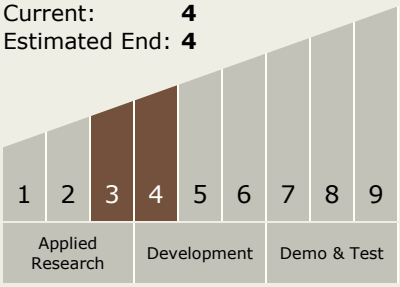
Carlos Torrez

Principal Investigator:

Karl Iagnemma

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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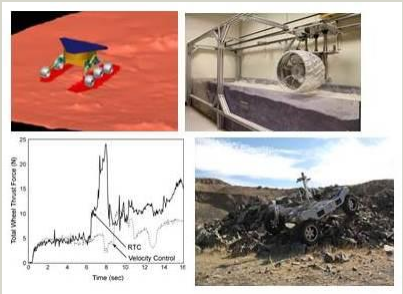
Images



Project Image
Advanced Algorithms and Controls for Superior Robotic All-Terrain Mobility Project Image
(https://techport.nasa.gov/image/133085)

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.1 Below-Surface Mobility

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System